Gennadi Vasilyev

Nature: Our Common Habitat

Gennadi Vasilyev

Nature: Our Common Habitat

Novosti Press Agency Publishing House
Moscow 1987

Designed by ***Natalia PAVLOVA***
Translated from the Russian by ***Boris LUNKOV***
English text edited by ***Juliette SHAPLAND***

Геннадий Васильевич Васильев
ПРИРОДА — НАШ ОБЩИЙ ДОМ
на английском языке
Цена 45 коп.

1603000000

© Novosti Press Agency Publishing House, 1987

CONTENTS

From the Author	5
The "Black Spots" of the Planet	7
The Difficult Steps of Ecodevelopment	12
Discussions on Ecological Problems	19
Ecology's Three Principal Elements	22
Under the Green Canopy	44
Resource Saving and Nature Conservation	50
What Can the Public Do?	53
Will the Earth Be Lucky a Third Time?	59

FROM THE AUTHOR

The relationship between man and nature has become one of the major problems facing civilization today. Ecology,* a vital philosophical issue, stands at the crossroads of politics, science and economics.

By journeying into space earthmen became aware that we all belong to one family living on a tiny island in the infinite Universe. This blue speck gave birth to life and the crown of its creation, *Homo sapiens*—Man thinking. In mastering nuclear energy man has developed a power which, unless controlled by his intellect, could extinguish life and snuff out our planet's blue glow. Therefore all of today's problems rotate around the one basic problem of war and peace.

In the event of war, the last lines of civilization's history will be written in thermonuclear ink. But if peace will reign, people will be able to solve their problems in the near future, put their house in order and clean up the excessive ecological rubbish. Our common home, divided into national sectors and separated into different social worlds, needs improvement along political, economic and ecological lines. But this is possible on only one condition: our home must not be burned down.

---

* The term "ecology", introduced into scientific language by the German biologist Ernst Haeckel (1834-1919), is derived from two ancient Greek words: "óikos" (house, dwelling) and "lógos" (word, discourse and by extension science). At first it denoted a division of biology dealing with the interrelationships of organisms and their habitats; later it was extended to include man and his relations with nature.

The socialist countries link their plans for the future, including extensive plans for the strengthening of environmental protection, with peace, friendship among nations, and the promotion of general cooperation in solving global problems.

THE "BLACK SPOTS" OF THE PLANET

While "blank spots" have practically disappeared from the Earth's geographical map, the "black spots" marking deserts, felled forests and other areas of ecological disaster, are expanding at a frightening pace. Man perfects everything, including his own shortcomings. Our ancestors naively considered the Earth's resources to be boundless and endless. The deserts of North Africa, our planet's thousand-year-old wound, were once fertile fields. The vegetation of vast expanses was stamped out and eaten up by countless herds of cattle, while the soil was eroded, blown away and supplanted by all-devouring sands.

The ecological ignorance of our ancestors was not their crime, but rather their woe, for it caused the death of thousands of animal species. The knowledge we have acquired does not entitle us to judge those who lived in the ancient, medieval or even recent times. Man has always had to fight a hostile environment, and the difficult road to his present rule over nature has been full of sacrifices and tragedies. Even in the 19th century, when the word "ecology" was born, people continued to use nature as consumers. For centuries our humanism has developed in a lopsided manner, proclaiming man the "lord and king" of nature, and not the child.

Human "achievements" in conquering nature became so great that man's economic activity began to have an increasingly negative effect on the biosphere. The advance of deserts, mining and construction usurps up to seven million hectares of land every year. Deserts and semi-deserts now occupy 53.3 million square kilometres, or more than one-third of the Earth's land surface. The

encroachment of sands swallows 44 hectares of fertile land every minute.

Forests disappear at a rate of 20 hectares a minute. The wholesale felling of tropical forests affects the Earth's entire population. Tropical forests, which account for 4/5 of the green cover of our planet and are one of the principal producers of oxygen, are reduced by one per cent every year. If this pattern continues, the tropical forests will cease to supply oxygen by the middle of the 21st century.

According to the International Union for Conservation of Nature and Natural Resources, 76 animal species and several hundred plant species of the Earth have become extinct in the last 60 years alone. Another 132 mammal and 26 bird species are on the verge of extinction. Furthermore, the rate of the disappearance of entire species is constantly rising.

This is tragic in that not only is the priceless gene pool being depleted but the delicate balance of nature, underlying the very existence of life on Earth, is being upset as well.

Today animals and plants perish not so much due to their physical extermination by hunting, fishing, or open-cast mining, as due to the production of chemical and other industrial pollutants, and the poisoning of the biosphere.

Nature's vitally important capacity to purify itself of industrial and other wastes has been nearly exhausted. Man has reached the fatal moment in time where it is absolutely essential that the needs of civilization be correlated to the resources of nature.

Each year the world economy ejects into the atmosphere over 200 million tons of carbon monoxide, more than 50 million tons of diverse hydrocarbons, 120 million tons of ash and nearly 150 million tons of sulfur dioxide, which fall back upon the Earth in the form of "acid rain".

Furthermore, thermal, noise and other kinds of pollution poison to some extent all ecological systems. There have been practically no studies of the negative effects of the mounting "electronic smog" emitted by radio stations, TV towers and thousands of millions of

electrical appliances, from the ordinary lamp to the personal computer.

Thus the activities of man today match the forces of nature. Carbon dioxide produced by burning fuel is already accumulating in the atmosphere faster than it is being absorbed by terrestrial and oceanic plants. Such examples are sufficient in number to confirm the idea, put forward by Vladimir Vernadsky,* that man-induced changes in the natural conditions on Earth have taken on a truly global character. Vernadsky pioneered the work on the problems of optimizing the relations between society and nature and showed, in particular, that the formation of our planet's appearance as it is today is mainly the result of the activity of living organisms. These organisms have produced the oxygen, nitrogen and carbon dioxide of the atmosphere. Although the mass of the planet's living matter is insignificant as compared to its total mass, the Earth is what it is today due to the plants and animals living on it.

Vernadsky wrote: "Mankind taken as a whole is becoming a powerful geological force. And the question arising before it, before its intellect and labour, is one of rebuilding the biosphere in the interest of humanity as a freely-thinking race."

It was largely due to the ideas of this Russian scientist that the concept of man's absolute domination of nature has given way to that of relations between equal partners.

But this change in attitude could have come about earlier. Today it is hard to believe that when I was in school, and that was only in the 1950s, my teacher in natural science lectured on the conquering of nature. It was difficult for people to understand that nature is not to be conquered, but rather cherished and cooperated with, and this cooperation must be on its terms. It is amazing that Vernadsky possessed this profound understanding in that the available factual material was quite limited in his time.

* Vladimir Vernadsky (1863-1945), an outstanding Russian scientist, the founder of geochemistry and of the biosphere and noösphere theory.

Vladimir Vernadsky's works laid the basis for the theory of the feasibility of man's transforming the biosphere into a "noösphere", a sphere of reason. The noösphere involves a balanced relationship between man and the environment, the absence of pollution, the use of natural resources in ways harmless to nature, and the scientific management of ecosystems. The development of the noösphere is the common and only intelligent way for Earth dwellers to face their future, which must be peaceful, humane and sensibly planned.

The first steps, although very timid, have been taken on this tortuous and long path. Most importantly, many people have begun to reappraise their values and to understand that one of the central causes of the ecological crisis is a consumer's attitude to nature.

The 1970s and the early 1980s may be described as "fifteen years of ecology", during which the interest in the society-to-nature relationship assumed a scale corresponding to the global character of ecological problems. People began to realize that the scale and impact of human activity are not only significant to regions and nations, but also to the planet as a whole.

Today economic, social, technological and biological processes are so intertwined and interdependent that it is clearly necessary to consider modern production as a complicated ecological-economic system.

It is impermissible to oppose the economy to ecology, as some scholars do, for such an approach will inevitably lead to extremes in one direction or the other. I contend that the way to establish a material and scientific base not only for protecting the environment, but also for its planned improvement, is not through reducing the growth rates of social production, as advocates of "zero growth" preach. Rather, this should be accomplished through further technological and structural progress of the economy and by making technologies and technical facilities ecologically cleaner.

The problem consists in being able to determine exactly the level of pollution that nature can handle, given its unique capability of self-purification and self-regeneration. Man and nature should interact and cooperate in order to build a sensible ecological-economic system.

Charles Darwin once said that nature cannot lie. Today it is essential that we realize that we ourselves cannot lie to nature. We know that nature is weak and defenceless before man, who has grown so strong. We should therefore base our relations with nature on the mercy for which she has ceaselessly appealed to our reason. The great Shakespeare, who believed in the omnipotence of human reason, wrote:

"There is a history in all men's lives,
Figuring the nature of the times deceased;
The which observed, a man may prophesy,
With a near aim, of the main chance of things
As yet not come to life, which in their seeds
And weak beginnings lie intreasured.
Such things become the hatch and brood of time..."

Our time is witness to the beginning of "humanized nature". Humanism is today what we need most of all, in politics, in relations among people, and in our attitude to nature. People of different convictions must work together to wipe the ugly "black spots" from the beautiful face of the Earth.

THE DIFFICULT STEPS OF ECODEVELOPMENT

Wholesale computerization, biotechnology, and the multiple recycling of resources, among other things, are opening up a basically new phase in the material and intellectual progress of civilization, which I venture to call, rather arbitrarily, **ecodevelopment**.

Ecodevelopment is a process of the rational and purposeful transformation of the environment in the interests of man. These are not immediate consumer interests but long-term goals which, I am confident, will help *Homo sapiens* (Man thinking) to eventually become *Homo felix* (Man happy). The basic objective of an ecologically balanced strategy of development is the maximum correspondence between a planned natural environment and the needs of mankind.

Today the first stones are being laid for the foundation of a future world economy, while its architectonics, structure and degree of ecological purity are as yet unknown.

Ecodevelopment is a complex of problems—economic, social, political, philosophical, moral and ethical.

During the last four decades the rise in living standards in many countries, and in particular Western countries, has followed a peculiar pattern which the Americans aptly describe as running up the downstair case. Every 15 years the output of goods and services doubled and so did the amount of industrial waste. By the mid-60s the pollution and poisoning of the soil, water and air had reached a critical level.

Well-fed and smartly dressed people, buying more and more cars and other durable goods gradually came

to realize that life amid noise, smog, and dead rivers and lakes, is far from pleasant. Life became increasingly abnormal, its material values declining and deteriorating. The devastation of nature gradually led to the loss of the most essential element of existence, a healthy biological habitat. It became increasingly clear that the acquisitive society is far from ideal. Thus the proverbial phrase "Man shall not live by bread alone" can now be supplemented with "but also by the gifts of nature, by its eternal beauty".

A reappraisal of values, though difficult and complex, is often essential. Many factors have led to the ecological crisis, in particular the consumer attitude toward nature. People striving to attain an immediate objective in disregard of natural laws simply destroy nature. The 1960s, for instance, witnessed a surge in the concern worldwide for the disastrous air pollution in London, Los Angeles, Tokyo and other big cities, for the tragic pollution of rivers and lakes, for the ruin of forests and for the degradation of the soil.

Environmental pollution has become in recent years a tangible obstacle to economic growth in industrialized countries. The discharge of dust and gas into the atmosphere affects crop yields and the quality of forests, reduces the catch of fish and promotes the corrosion of metals.

Ecological problems have far-reaching social implications. Environmental pollution destroys the human habitat and thus enhances the incidence of disease and raises the cost of medical services. The increase in the rate of sickness also reduces the available labour resources. Thus, the correlation of economic and ecological interests is extremely important.

The objective contradictions between nature and society are particularly aggravated in a capitalist economy which is dominated by private-owner interests.

The economic policy of the capitalist state consists in ensuring colossal profits for the monopolies **by all possible means.** The guiding principle of these leading polluters of the environment is maximum profit at any price.

The basic cause of the ecological crisis is the unlimited power of the monopolies exploiting nature, for exploi-

tation "costs nothing". In a society ruled by the laws of "free enterprise" the state cannot fully control the location or the functioning of economic facilities, including the "ecologically dirtiest". If industrial concerns find it cheaper to pay "moderate fines" for environmental pollution rather than build costly waste treatment facilities they can follow this procedure for years. This is exactly what the West German chemical corporations Hoechst, Bayer and BASF have been doing, thus making the Rhine one of Europe's dirtiest rivers.

Considerable efforts have been made during the last few decades to solve ecological problems in capitalist countries. Allocations for environmental protection have been sharply increased (they reached a record figure in Japan), and various departments have been established to supervise nature conservation. The ecological movement is broadening, and environmentalist parties (e.g., the Greens in Federal Germany) have been formed. Various environmental protection programmes are being implemented with taxpayers' money. But the efficacy of ecological policies remains low.

The prevention of ecological disturbances demands coordinated and comprehensive policies on the state level, and an integrated complex of long-term measures. But private ownership of the means of production serves as the main obstacle to the solution of ecological problems in the capitalist world.

Socialist society, where the means of production, the land and natural resources belong to all the people, makes possible the use of nature in the interests of the entire community. In socialist countries, the problems of protecting nature are tackled statewide, and on a scientific and integrated basis. This comprehensive approach, which includes the construction of treatment works, ecologization of production, the closure of small boiler houses in towns, the planting of greenery, and rigid environmental control, even to the extent of closing polluting enterprises, offers maximum opportunities for coping with ecological problems.

Sufficient research has been done and technological facilities are available to fight all kinds of pollution effectively. The achievements of the scientific and technological revolution are an important factor in the

solution of ecological problems. But some bourgeois ecologists maintain a directly opposite view. They claim the scientific and technological revolution to be the principal cause of the ecological crisis and urge the termination of scientific and technological development.

Scientists in socialist countries believe that the contradictions between society and nature can be overcome without lowering the rates of scientific and technological progress, for without progress human life is inconceivable. Nature is not destroyed by scientific and technological progress itself, but rather by **whom** and **how** this progress is employed and at whose profit.

In socialist society the achievements of the scientific and technological revolution are used not to further the incomes of individuals, but to better the living conditions of all citizens. That is why all people are interested in applying these achievements for the purpose of nature conservation.

One of the advantages of socialism is that the masses participate in implementing all governmental plans and decisions. This has been noted in the West as well. Here is just one example. Thane Gustafson, an expert in constitutional law at Harvard University, USA, wrote that "...the concerns of the environmentalists [in the USSR] happened to match... those of the central leadership...". This is exemplified by the consideration of nature-conservation problems in the plan for national economic development.

Environmental protection policies have been raised to the state level in socialist countries. Provisions on nature protection have been incorporated into the Constitutions and special laws have been passed based on the underlying principle of concern for the health and wellbeing of the countries' citizens.

By Lenin's initiative, soon after the October 1917 Revolution, scientists were assigned the task of ascertaining and accurately describing the country's natural resources to ensure their rational use. Lenin initiated and elaborated the Soviet legislation on conservation of nature and the thrifty use of its resources. He signed more than one hundred legal acts related to this issue.

The Soviet Constitution defines nature conservation

as one of the major functions of the state, reflecting Lenin's concept of society's thrifty attitude to the environment. Article 18 of the Constitution reads: "In the interests of the present and future generations, the necessary steps are taken in the USSR to protect and make scientific, rational use of the land and its mineral and water resources, and the plant and animal kingdoms, to preserve the purity of air and water, ensure reproduction of natural wealth, and improve the human environment."

The duty to promote nature conservation is included in many other articles of the Constitution as well. Environmental protection is regulated in the USSR by legal acts such as the Fundamentals of Land Legislation (adopted in 1968), the Fundamentals of Legislation on Water Resources (1970), the Fundamentals of Mining Legislation (1975), the Fundamentals of Forest Legislation (1977) and the Laws on the Protection and Use of the Animal World (1980) and on Air Protection (1980). Provisions for environmental protection are also included in other Soviet legal documents, such as the Fundamentals of Legislation on Public Health, and on Labour.

Environmental protection is also regarded as an integral element of the social policy of other socialist countries. It is increasingly felt that the level of wellbeing should be measured not only by per capita incomes and the amount of available goods and services but also in terms of environmental quality. The five-year and annual development plans of socialist countries include a special section on nature conservation, which supplements the complex of measures aimed at raising the level of quality of life. It is logical that ecological parameters should soon become a key factor indicating the standard of living.

It has been proposed to include ecological factors in the indicators of an enterprise's performance. Personnel will thus be encouraged to take more vigorous steps in preserving nature and introducing waste-free technologies at their enterprises.

Ecology and raising the quality level of the environment play an increasingly important role in the system of norms based on scientific research. This system is

one of the leading principles of the planned economy in socialist countries.

For example, notable progress has been made in the USSR in the hygienic rating of environmental factors. An elaborate system has been developed to ensure the purity of the air, water and soil. Compulsory requirements have been established in the form of maximum permissible concentrations* of harmful substances in the environment. (The Soviet Union was in 1951 the first country in the world to introduce maximum permissible concentrations.) These requirements are designed to keep the level of pollution as low as possible and to prevent its harmful effect on human health.

All these rates and norms are closely interlinked and serve to fulfil the basic social task of protecting the health of the present generation and future generations as well.

The State Committee of the USSR for Hydrometeorology and Environmental Control and other government agencies have been established to supervise permanently ecological conditions in the country. These agencies enjoy extensive rights, including the right to suspend production if air or water protection norms are being violated. In 1984-1985, for instance, nearly 700 factories and shops were closed because their discharge into the air and water bodies exceeded permissible rates.

On the whole the ecological situation in the Soviet Union is constantly improving. The growth of air, water and soil pollution was halted in the early 70s without affecting the country's economic development.

The fact that many countries, both in the West and in the East, have made progress in nature conservation is no reason for complacency, especially since the number of most urgent problems is not diminishing. "Acid rains" are a case in point.

These rains are known to be caused by a high level of air pollution by sulfur dioxide, which is emitted in

---

* Maximum permissible concentrations of more than 2,500 harmful substances in the soil, water, air and in food have been established in the USSR. Soviet norms of environmental quality are more rigid than those in Western countries.

particular by the smoke stacks of power stations, oil refineries and metallurgical plants.

But even the most radical national measures may prove futile if the given environmental problem is not properly tackled in neighbouring countries as well. We share a single world, and nature knows no boundaries. The problem of transboundary pollution is therefore acute the world over.

"Acid rains" falling on Canada are formed in the polluted atmosphere of the United States. It is estimated that only 20 per cent of Austria's "acid rains" are of domestic origin.

"Acid rains" forming over Western Europe pour on Scandinavia. Every year more sulfur falls upon Norway than is produced within the country.

Cyclones originating in the Atlantic determine the weather of the European USSR for a greater part of the year. In 1980 alone Western winds brought to Soviet territory over three million tons of sulfur dioxide and nearly 2.5 million tons of sulfuric acid and sulfates. To counter the effects of these compounds our country has to spend millions of roubles, mostly on deacidification, and also on intensive reforestation of areas damaged by "acid rains".

The ecological interdependence of countries both far and near one another is obvious. No single country can solve completely the problem of "acid rain", for it requires concerted efforts.

The Soviet Union has more than once initiated discussion of environmental problems at the international level. It proposed the convocation in 1979 in Geneva of the All-European Conference on Cooperation in Environmental Protection at which 34 states examined the draft Convention on Long-Range Transboundary Air Pollution. In being the first to ratify the convention, the USSR demonstrated its readiness for broad international cooperation.

The Soviet Union was also an initiator of the conference of 30 countries held in Helsinki in 1985 to consider the reduction of sulfur dioxide discharges and their transboundary transfer. The conference adopted a protocol prescribing the reduction by 30 per cent of sulfur discharges into the atmosphere by 1993.

DISCUSSIONS ON ECOLOGICAL PROBLEMS

These discussions are held practically all the time and millions of Soviet people take part in them. A bitter dispute flared up recently over the proposed transfer of some of the waters of Northern rivers to the Volga basin. The project, intended to be launched in the next few years, immediately met with vehement resistance from both residents of the Soviet European North and intellectuals living in other areas. Employing mathematical, artistic and other arguments, scientists, writers and experts in various fields showered the idea with criticism. Particularly powerful was the reaction of the well-known writers Viktor Astafiev, Vasili Belov, Yuri Bondarev, Sergei Zalygin, Leonid Leonov, Valentin Rasputin, and Academician Dmitry Likhachev, a prominent literary scholar. Their letter expressing anxious concern for the issue was published in early 1986 in the newspaper *Sovetskaya Rossiya* and evoked broad public response.

"We", said the writers, "have carefully examined the economic, social and technological aspects of the project's feasibility study, we have visited the North on many occasions, and have heard the opinions of scientists, leaders of the regions concerned and volunteers working to protect cultural and historical monuments. We have also met with the project's creators and with the heads of national agencies in charge of land improvement.

"All this allows us to consider the transfer project as lacking in thoroughness and scientific validation.

"Its cost is without precedent in previous construction projects worldwide.

"The project's creators do not know the possible effects of a decreased supply of fresh water to the Arctic Ocean, which is the 'weather cauldron' of not only the Northern Hemisphere."

The project's creators advance their own arguments. Only recently they claimed that the transfer of the flow of Northern rivers is essential to maintain the water level of the Caspian Sea which is the country's main habitat for sturgeon and other valuable fishes.

The amount of water, emptying every year into the Caspian Sea from the Volga, Europe's largest river, along which numerous hydroelectic stations and water reservoirs have been built, has decreased by almost 40 cubic kilometres. The level of the sea began to drop, and its shallowest and most productive area located in the Northern part of the sea shrank by 25 per cent. But then the Caspian began to "cure itself". Since 1978 the water level has risen by 1.14 metres and the volume of water has increased by 400 cubic kilometres. This exceeds nearly 70-fold the amount of water to be channelled off annually from the Northern rivers—5.8 cubic kilometres.

Exactly why the sea "cured itself" is unknown, even though such phenomena have occurred in the past. This is a classic example showing that despite all the miracles of the scientific and technological revolution, our understanding of the laws of nature is relatively modest.

The project planners were forced to change their argument to claim that Northern water was needed to irrigate the arid Lower Volga region. Their opponents used intricate calculations to prove that as much as 60-80 cubic kilometres of water a year could be saved simply by introducing a new system of farming technologies and through a more rational use of water for industrial and household needs. In short, the discussion which has been raging for several years has finally reached its climax in 1986.

The truth probably lies somewhere in-between the two arguments. The development and implementation of such projects both in the USSR and in other countries seem to be a more appropriate approach for the coming generations whose ecological horizons and facilities will be broader. For one thing, the future gener-

ations of computers will enable our descendants to process data in much greater amounts than we can handle today. Today it would be prudent for the present generation, with its rudimentary knowledge of ecology, to abide by the postulate of Hippocrates: "Non nocere" ("Do no harm").

"Ecological surgery", including interbasin water transfer, elimination of deserts and global climate control, is a project for the perhaps-not-near-future. Mankind simply has not yet reached this stage of development. Wishful thinking is known to have wrought many ecological calamities in the past.

The broad public criticism of the proposed transfer of part of Northern rivers' flow to the Volga eventually led to the suspension of this project.

ECOLOGY'S THREE PRINCIPAL ELEMENTS

Water

It may be hard to believe, but at present half of the world's population is suffering from a shortage of drinking water. The United Nations has declared the 1980s the International Drinking Water Supply and Sanitation Decade.

The world community faces the strenuous tasks of providing the entire planet's population with clean drinking water and of building efficient purifying facilities.

Fresh water is a unique gift from nature, while pure water is a national asset. According to some estimates, the consumption of fresh water will have increased eightfold by the year 2000. Water is irreplaceable. It may very well be that by the end of this century Lake Baikal, which stores the purest and, according to experts, the tastiest water on Earth, will become the drinking well for many countries.

Lake Baikal is 20 million years old, a thousand times as old as any other lake in the world. No other lake is more than 15,000 years old. Scientists believe that millions of years ago a terrible earthquake left a gaping gash on the body of the Earth, into which mountain rivers rushed from a height of hundreds of metres. Three hundred and thirty-four rivers poured into the stone bowl, and when it was full to the brim, one of the rivers was forced to turn back. Only the Angara runs out of the Baikal while 333 other rivers empty into the fabulous lake.

Lake Baikal contains one-fifth of all fresh water in the world, enough for the entire population of the Pacific basin for almost 100 years at the Moscow rate of water consumption of 500 litres a day per person. For the

Soviet Union's population (278.7 million as of January 1, 1986) this water source would suffice for nearly 1,000 years.

The Baikal's shores are moving apart just as those of Africa and Latin America, at a rate of two centimetres a year. Lake Baikal is like an ocean, only on a much smaller scale: there are high and low tides, and seiches (oscillations occurring on the surface of a lake thought to be caused chiefly by local variations in atmospheric pressure).

The Limnological Institute of the Siberian Branch of the USSR Academy of Sciences, built on the lake 70 kilometres away from the city of Irkutsk, is conducting a study of the Baikal. The motto of its staff is: "To study means to preserve". The institute was the first to stress the need for an exceptionally careful approach to everything connected with the lake.

Heated debates on the future of Lake Baikal began in the Soviet press back in the 60s in connection with the construction of industrial enterprises on its shores. This construction presented a real threat to the lake's extra pure, almost distilled water, to its inhabitants—the Baikal seal, the viviparous fish golumyanka, the Arctic cisco and the grayling—and to the local plants. Prominent scientists and writers discussed and argued the fate of the lake in newspapers and periodicals and readers sent anxious letters from all parts of the country.

It was then decided not to build a timber port on the Baikal but to transport timber by rail instead of floating it across the lake. The Baikal pulp-and-paper mill, which had already been built, was provided with unique purification equipment.

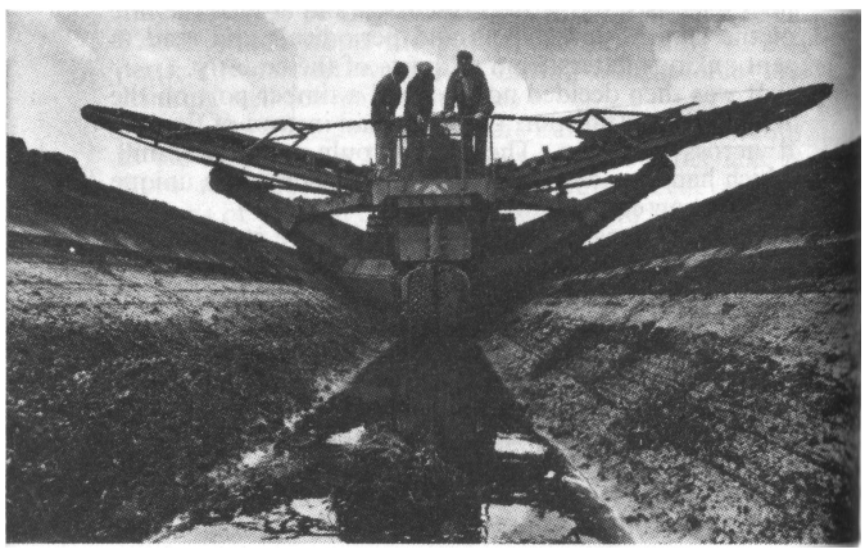
Today dozens of research institutes are studying the Baikal's "health". Much has been done for its protection. Timber drifting has been ended, the felling of trees on the shores has been sharply restricted, and larger areas around the lake have been declared costal forest preserves and sanctuaries where not a single tree may be cut. During the construction of the Baikal-Amur Railway the tracks were laid much farther to the north of the shoreline than had been originally planned. Every enterprise in the region now has its own special maintenance programme for preserving nature.

The Baikal's water has remained so clear that a fish can be seen 40-50 metres from the surface. The stocks of the Arctic cisco which had begun to diminish have now been replenished, and the annual catch of the valuable fish is strictly limited on a scientific basis.

Despite the fact that the Baikal pulp-and-paper mill has an excellent waste-treatment system, a possible change in its specialization is being examined to maintain environmental requirements. Another mill, located on the banks of the River Selenga which empties into the Baikal, is switching over to a recirculating water supply.

The USSR Academy of Sciences has been awarded a special UN medal and prize for outstanding achievements in environmental protection for its efforts in preserving Lake Baikal, the purity of its water, and its diverse and unique fauna and flora.

In spite of the Soviet Union's large water resources (the total annual run-off of its rivers equals 4,300-4,700 cubic kilometres) many areas are already suffering a water shortage. While the average per capita water



supply is 17,000 cubic metres, in some parts of the country the average is below 2,000 cubic metres. The available water resources, therefore, should be used as rationally as possible.

During the last ten years comprehensive measures for the more rational use of water have been applied in 135 cities and towns and at 1,045 enterprises. The broad application of water recirculation and recycling has reduced the annual intake of fresh water for industrial needs by 240 cubic kilometres, which is almost equal to the annual run-off of the River Volga. In 1985 alone the fresh water intake dropped by 21 cubic kilometres. The Caspian Sea and the Sea of Azov, which are unique fish basins, are today much cleaner.

Although the topic of land improvement is probably most appropriate for the chapter on soil, I have decided to include this issue here. It will become clear as to why.

An extensive land improvement programme is under way in the USSR whose vast territory has a wide variety of climates. Its purpose is to establish large zones guaranteeing farm production where grain, fodder and vegetables would be produced by efficient industrial methods. The programme provides for increasing the total irrigated area to 30-32 million hectares and the drained area to 19-21 million hectares by the year 2000.

Land-improvement work is underway in Byelorussia, located in the western European USSR, where much of the land is waterlogged.

An irrigation system in the Crimean Peninsula.

Land improvement involves both the irrigation and drainage of land. The task in both cases is to make the land fit for productive economic use.

Before such an intrusion into nature can be started, it is vitally important that every factor be considered, and that the character and methods of soil modification be determined and its possible consequences examined.

The quality of amelioration and the skillful use of the improved land are equally important. In short, the land's fertility and its conservation depend on the concerted efforts of scientists, engineers and farmers.

Raising the efficiency of irrigation is an acute agricultural problem. Water losses during irrigation are too great and often unwarranted. In the hot Central Asian republics,* for instance, the efficiency of irrigation of some of the cotton and other plantations sometimes drops to 50 per cent: half of the water fails to reach the fields because of evaporation or because of seepage resulting in soil salinization, etc. The waterproofing of irrigation canals in particular must be improved, with special methods involving costly plastic film.

The excessive intake of fresh water for farming purposes has created a problem in two of our Southern seas—the Sea of Azov and the Aral Sea.

The Sea of Azov is one of the world's smallest (38,000 square kilometres). It is also the world's shallowest sea, with an average depth of only four metres. But it has always been famous for its productivity: there was a time when 80 kilograms of valuable fish were caught annually per hectare of water surface, an annual catch over six times as great as that in the Caspian Sea and 53 times as great as that in the Mediterranean Sea. This occurred because the major rivers Don and Kuban empty into the Sea of Azov which thus received an ample supply of fresh water, part of which escaped to the Black Sea through the Kerch Strait. The construction of irrigation dams on the rivers reduced the supply of fresh water to the Sea of Azov so sharply that water from the Black Sea, which is twice as salty as that of the

* The Uzbek, Turkmen,Tajik and Kirghiz Soviet Socialist Republics of the Soviet Union which comprises a total of 15 Union Republics.

Land reclaimed from the desert in the Tajik Republic.

Sea of Azov, pressed its way into the Sea of Azov through the strait. As a result, the fish stock in the Sea of Azov was drastically diminished.

Several projects to replenish this stock have been proposed. One of the more feasible is to build dams with fish-runs and a navigation lock in the narrowest part of the Kerch Strait. The Sea of Azov may thus be desalinized by regulating the access of Black Sea water to the level necessary to restore its fish stock. But this project also has its supporters and opponents.

The situation in the Aral Sea is also very grave. More than half of the waters flowing into it from the rivers Amu Darya and Syr Darya—60 cubic kilometres—fail to reach the sea, in that they are used for irrigation. By the year 2000 the entire run-off of these rivers is expected to be used for irrigation. As a result, the water level of this land-locked sea will drop by 17-30 metres and it could become a shallow body of water as lifeless as the Dead Sea due to the extremely high salt concentration.

The numerous projects for saving the Aral Sea include the transfer of a part of Siberian rivers' run-off to Central Asia and Kazakhstan. But this project is unpredictable ecologically, and we are not yet prepared

either to develop or implement it. That is why the primary task now is to improve the use of irrigation water and sharply cut its losses in order to slacken the rate of shallowing of the Aral Sea. But no realistic and sure way of saving the inland sea has been found, which causes much concern for the Soviet public.

The period 1986-1990 will witness the implementation of major measures for the protection of the basins of the Baltic, Caspian, and Black seas, and the Sea of Azov. Fundamental measures will be continued to conserve the bodies of water of the Arctic basin, Central Asia and Kazakhstan* and also for improving the conditions of small rivers and water reservoirs.

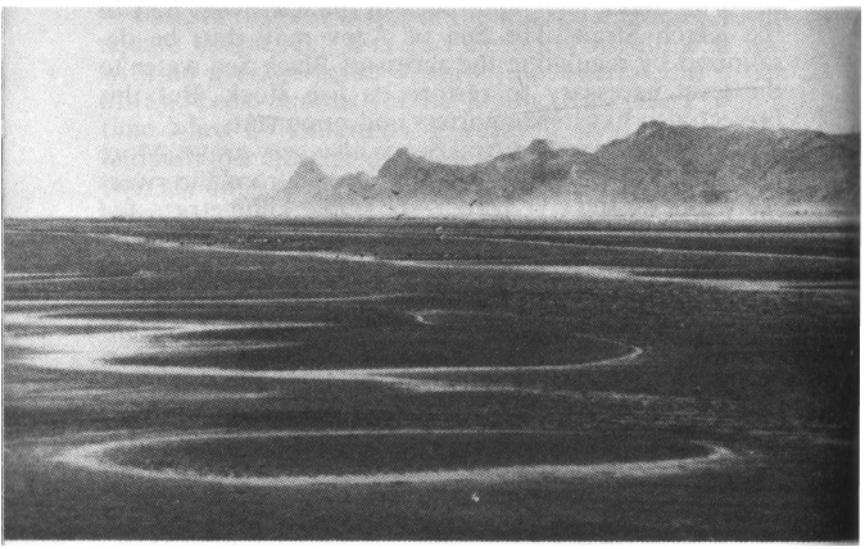
Small rivers supplying major water arteries are highly vulnerable ecologically precisely because of their small size.

Deep public concern has been expressed in the Soviet Union for their unsatisfactory condition. This matter has been extensively and heatedly discussed in the press.

---

* One of the 15 Union Republics of the USSR.

The shallows of the Aral Sea.



Considerable progress has been made since 1980 when the Soviet government passed a special provision on the protection of small rivers.

There are nearly 150,000 small rivers in the Soviet Union and water-protection zones have been and continue to be established along these rivers. Though far from sufficient as yet, these zones continue to grow.

Local authorities and community groups have joined government agencies engaged in the work of protecting small rivers, brooks and springs. In the Tula Region, south of Moscow, various enterprises and organizations have all been put in charge of a certain stretch of a nearby small river. The employees of these organizations "guard" the purity of water in their river, the condition of its banks and vegetation and carry out various environmental measures. This is only one example of the various kinds of work to protect small rivers underway throughout the country. But neverthe-

Members of the "Forest Protector" club in the town of Pushchino, near Moscow, help preserve springs.

less much work remains in coping with this urgent problem.

The introduction of waste-free production with a recirculating water supply is an important factor in the conservation of small rivers and others as well. This is the call of the times.

The Soviet Union is tackling many ecological problems together with other CMEA* member countries. The socialist countries have initiated multilateral international cooperation in resolving contradictions between society and nature. The community of their socio-economic systems and their unity of purpose promote the close cooperation of the socialist countries.

International cooperation is contributing increasingly to the cause of environmental protection. Exchange of experience enables countries to save time on research and development and to apply the available effective means of nature conservation. Depending on the means available, each CMEA country undertakes the development of a particular problem, while the results are shared by all socialist states.

The countries of the socialist community have been cooperating in ecological matters since 1972. It was in 1972 that the CMEA Executive Committee approved the programme of cooperation for the period up to 1980 in the sphere of environmental protection and the improvement and the rational utilization of natural resources. More than 2,000 projects were completed under this programme. A similar programme was then adopted for the period up to 1985 and was subsequently fulfilled.

A new stage in this cooperation was marked by the adoption in late 1985 of the Comprehensive Programme for Scientific and Technological Progress of CMEA Member Countries up to the Year 2000, which also provides for further interaction in environmental protection.

The socialist countries cooperate in ecological matters

* CMEA—the Council for Mutual Economic Assistance—is an intergovernmental economic organization of socialist countries, founded in 1949 and composed of Bulgaria, Hungary, Vietnam, the German Democratic Republic, Cuba, Mongolia, Poland, Romania, the USSR and Czechoslovakia.

in many directions. A few examples are listed further.

The scientists of the Soviet Union, Hungary, Czechoslovakia, Romania and Yugoslavia are working together on the problem of protecting the waters of the River Tisza, a major tributary of the Danube. With industrial production developing rapidly in the countries of the Tisza basin, a long-term programme provides for the simultaneous construction of waste-treatment facilities at enterprises and in communities of these fraternal countries.

Still other joint projects are being implemented. The Soviet Union and Romania, for instance, have built a hydroengineering complex on the River Prut, which irrigates large tracts of land and prevents floods. Hungary and Czechoslovakia are constructing the major hydroengineering complex Nagymaros on the Danube. The USSR and Mongolia are working jointly to protect the River Selenga from pollution. This project is very important for the conservation of Lake Baikal.

The international economic partnership "Intervodoochistka" (Inter-water purification), which has been functioning under the CMEA since 1977, coordinates the specialization and joint manufacture of equipment for water purification and the construction of the latest types of treatment plants.

Hungary, for instance, benefits from the collective experience in waste treatment at pulp-and-paper mills, and Bulgaria, at enterprises processing farm produce. Closed water recycling systems have been introduced at many iron-and-steel mills of the German Democratic Republic, Poland, the Soviet Union and Czechoslovakia.

Czechoslovak specialists have developed and are now manufacturing automatic water monitoring stations which have been operating well in other CMEA countries.

Socialist countries also cooperate actively with Western states in solving the ecological problems of certain regions. The protection of the Baltic basin serves as one example of this cooperation. One hundred and forty million people live on the Baltic shores, where many major industrial zones are located. All of this combined with the active navigation of the sea naturally affects the

state of the sea water and the shoreline flora and fauna.

Both international law and the national laws of the coastal states define the legal regime of environmental protection of the Baltic Sea. Agreements among these states stipulate measures to prevent oil pollution of the sea and the dumping of harmful substances, to organize rational fishing and the preservation of marine life, and to carry out other environmental provisions.

The air

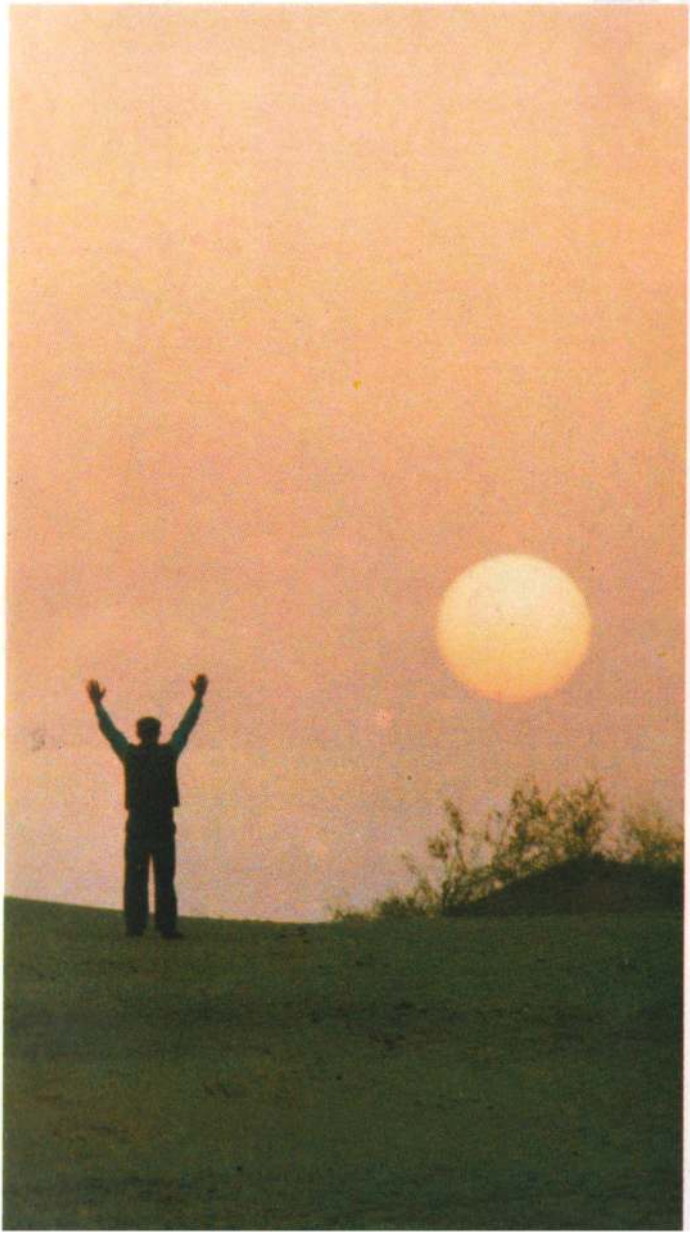
Of the more than 400,000 cities and towns in the world today, 75 per cent have a population of less than 20,000. The number of "millionaire cities" has also been growing rapidly: while their number was only 11 in 1920, it is expected that it will reach the 300 mark by the year 2000.

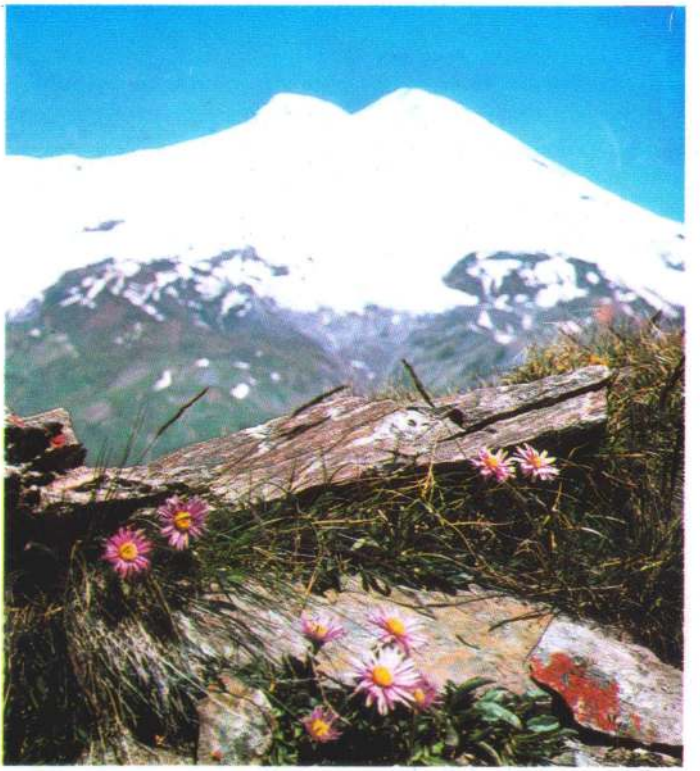
Urban ecologists obviously had their reasons for referring to cities as "ecological parasites". Spacemen have seen "veils" of dust 500 and more metres thick hovering constantly over large cities. The amount of harmful substances discharged into the air in New York, for instance, is 340 kilograms per person.

The air in Soviet cities is as a rule cleaner than in other countries. Foreign ecologists contend that the sky above Moscow (population 8.7 million) is much clearer than that over Tokyo, New York, London and other giant cities. This is primarily due to the extensive use of centralized heating in Moscow. Most of its houses are heated and supplied with hot water by large power-and-heating plants that have long been burning natural gas. The removal of a great number of small coal-burning boiler houses purified the air considerably.

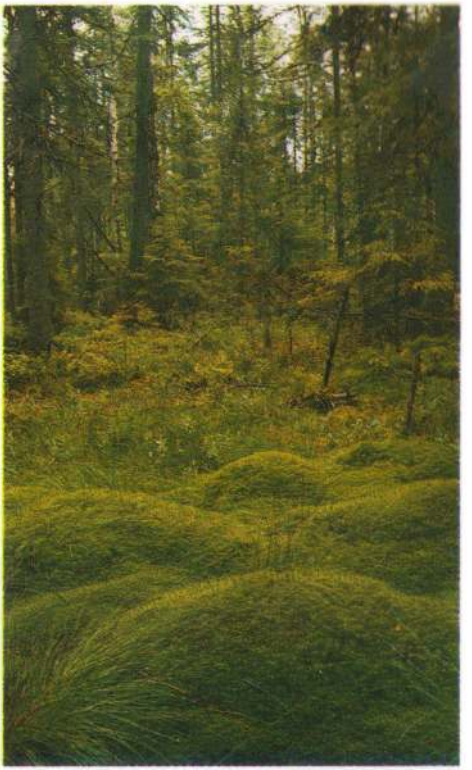
Moscow, one of the world's greenest cities, is encircled by a belt of parks and forests many kilometres wide. Dozens of ecologically harmful industrial enterprises have been moved out of the city. Large numbers of lorries now use liquefied or compressed gas rather than petrol.

Air has become cleaner in Leningrad, Kiev, Minsk and many other large Soviet cities as well. Donetsk, the central city of the Donets Basin, a major coal-producing





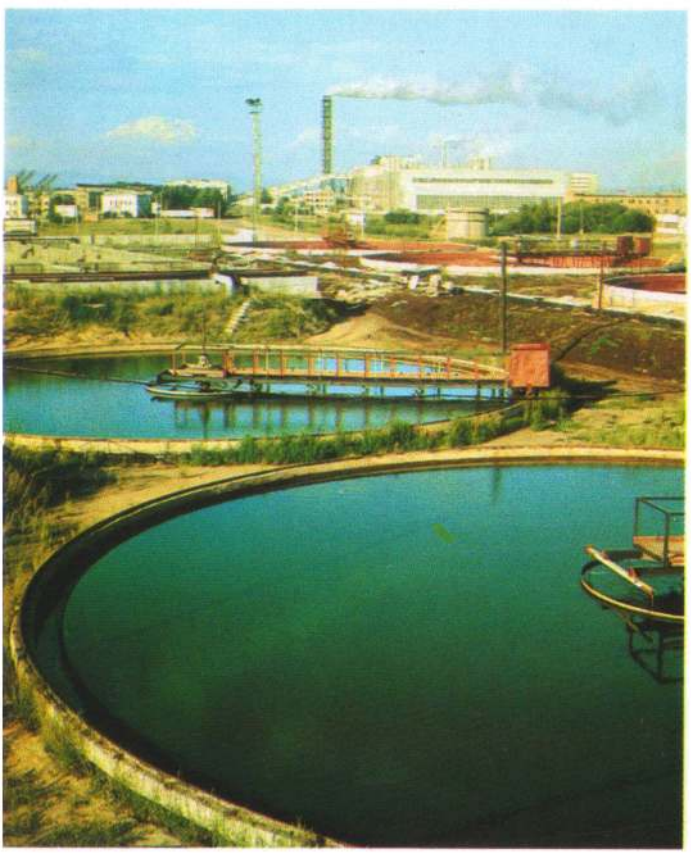
The white mountain caps, the blue skies, the quiet nooks of the forest and the broad plains are beautiful aspects of our Earth.

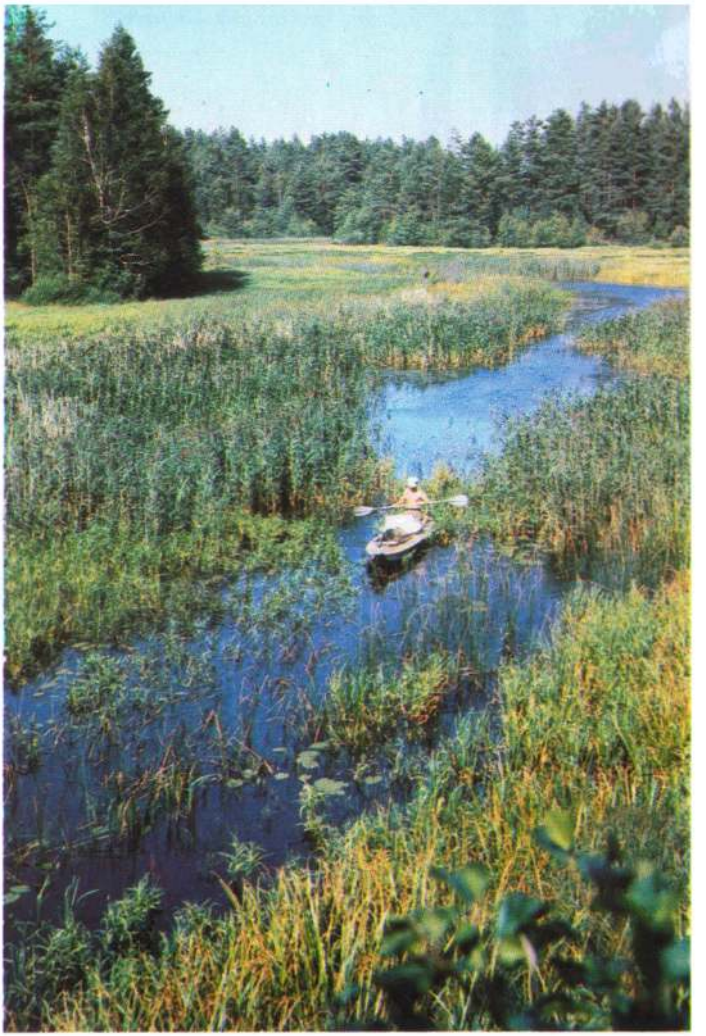


Earth is the nursing mother for the whole world. But it rewards man with bumper crops only when he shows himself to be a wise and provident husbandman and keeper.

As a result of the purposeful recultivation, replanted forests, flowering gardens and man-made lakes appear to take the place of dusty waste dumps and gaping quarries.

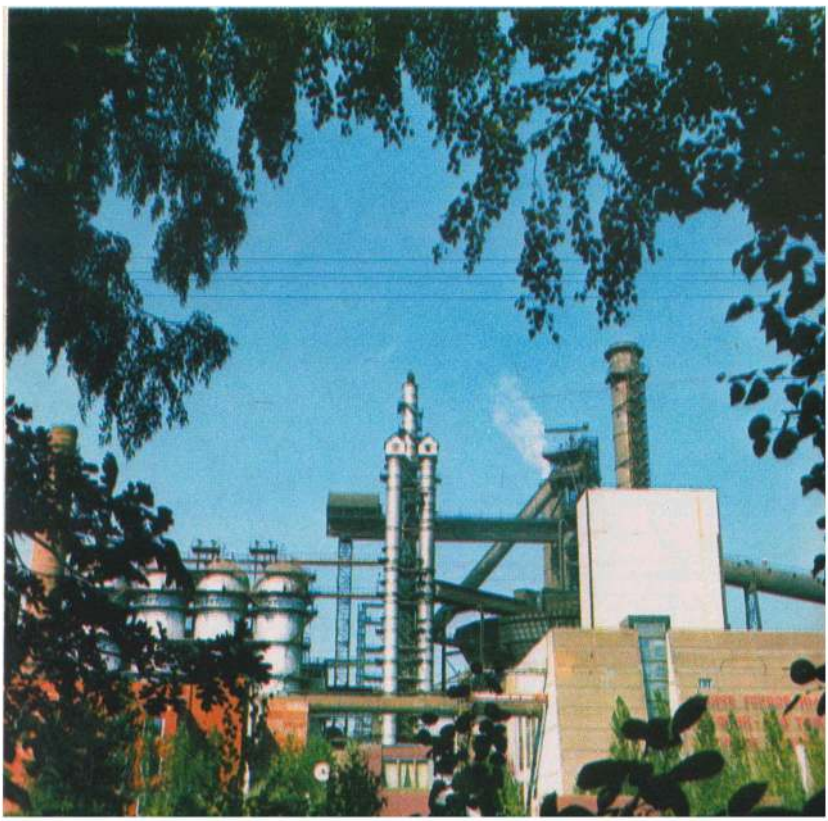
Water can give life to arid fields and be used for urban and industrial purposes only if it is clean and unpolluted by industrial wastes.



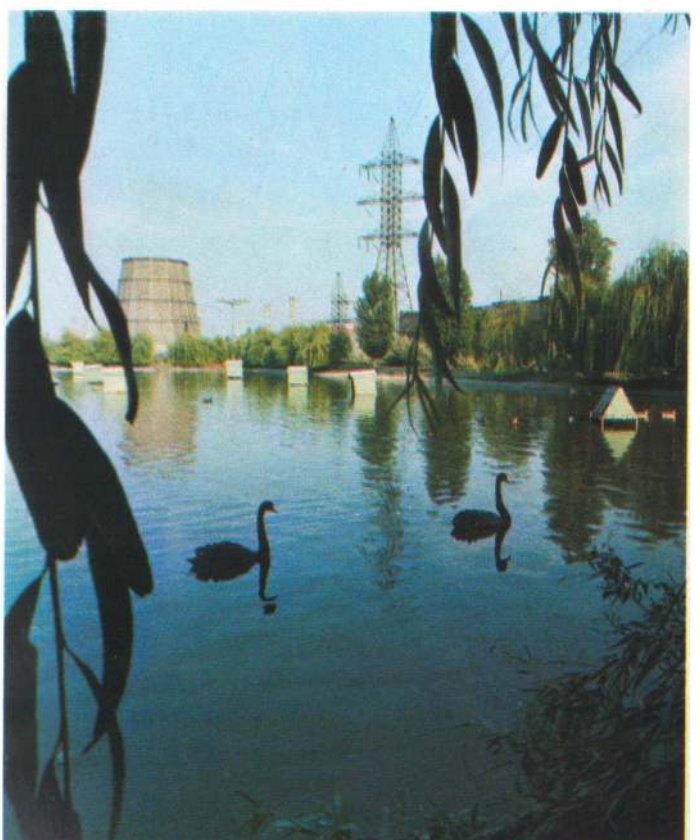


Inconspicuous springs and mossy bogs give rise to streams which feed major rivers.

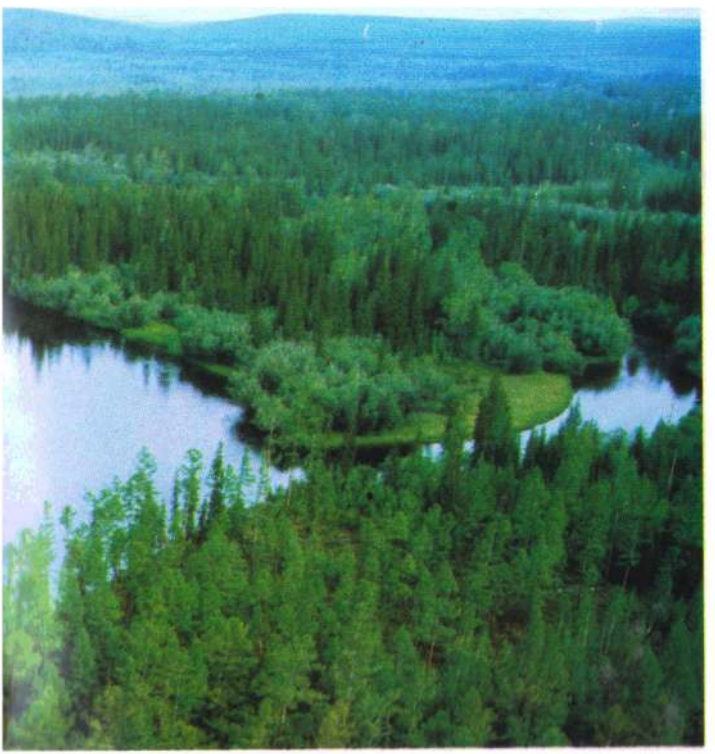
Waste-free industrial production will help us restore the purity of the air and water and keep the greenery fresh.



It will then be natural for swans to nestle near factory grounds.

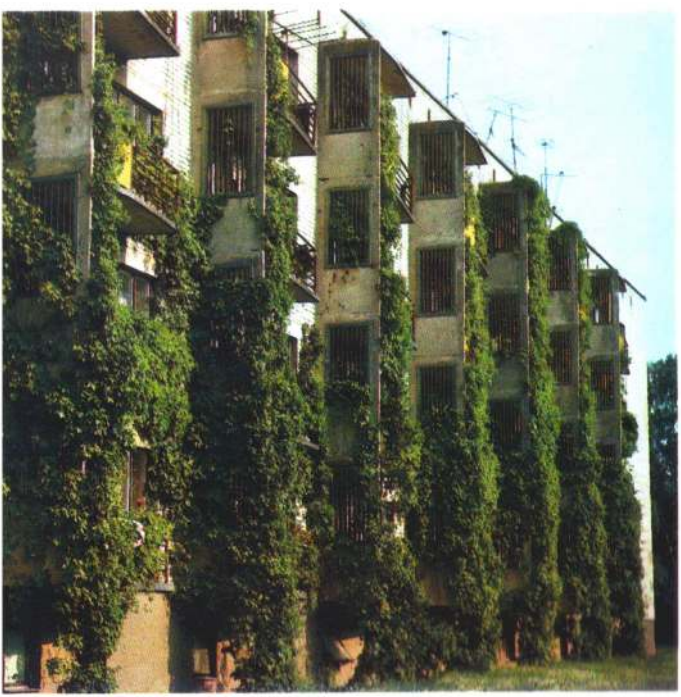


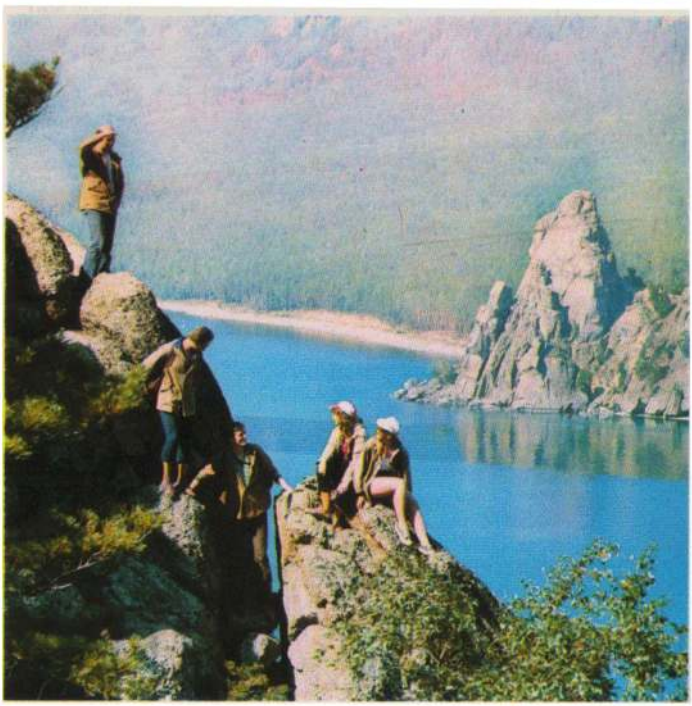
Forests are often called the lungs of the planet, for they are the main absorbers of carbon dioxide and dust. That is why it is essential not only to save them from extinction but to replenish this green wealth of the Earth.



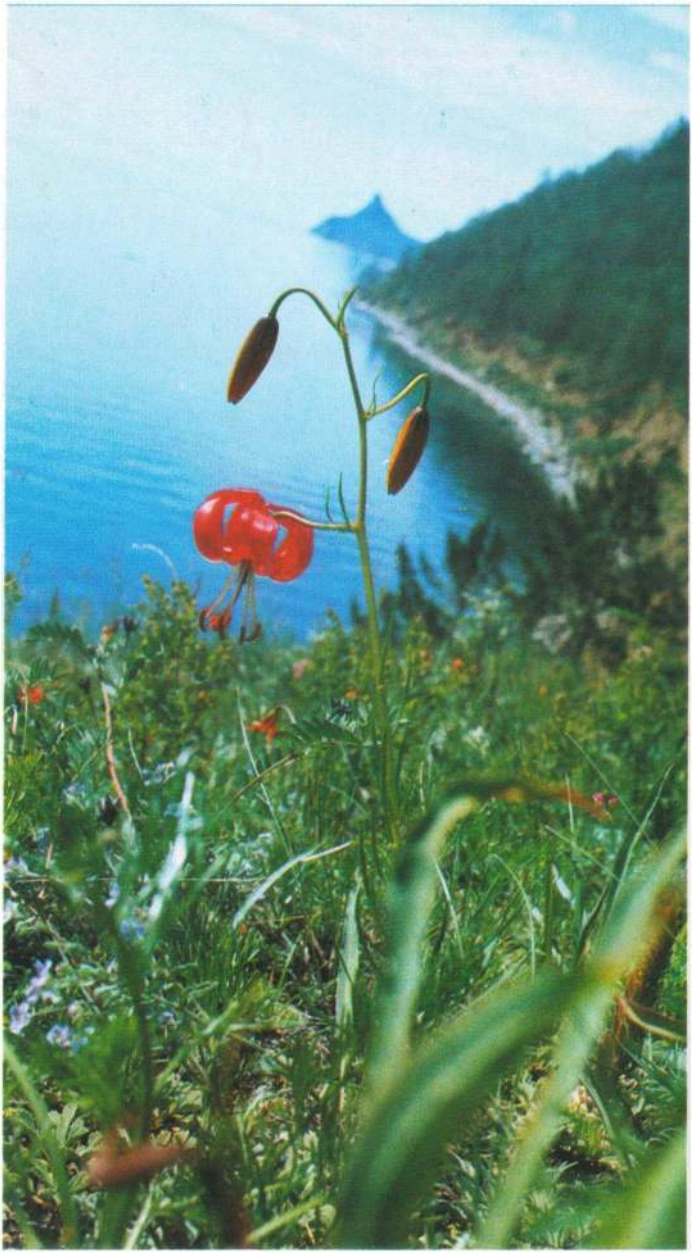
Dust in the air, a shortage of clean water and overpopulation are among the increasingly acute ecological problems facing urban areas. Turning towns into a healthy and comfortable human habitat is a major social task which is being implemented vigorously in the USSR.

Noise is one variety of ecological pollution. The residents of many towns suffer from "noise smog". Audiologists are increasingly doing important work by monitoring the noise level in the streets, at factories and in residential areas, and recommending measures to reduce it.





Man is a component of nature, and his attitude to it—heedlessly consumerist or rationally humane—will determine whether he will deprive himself and his descendants of the Earth's beauty or replenish everything that lives on the planet.



area, has been awarded an international prize for its environmental achievements.

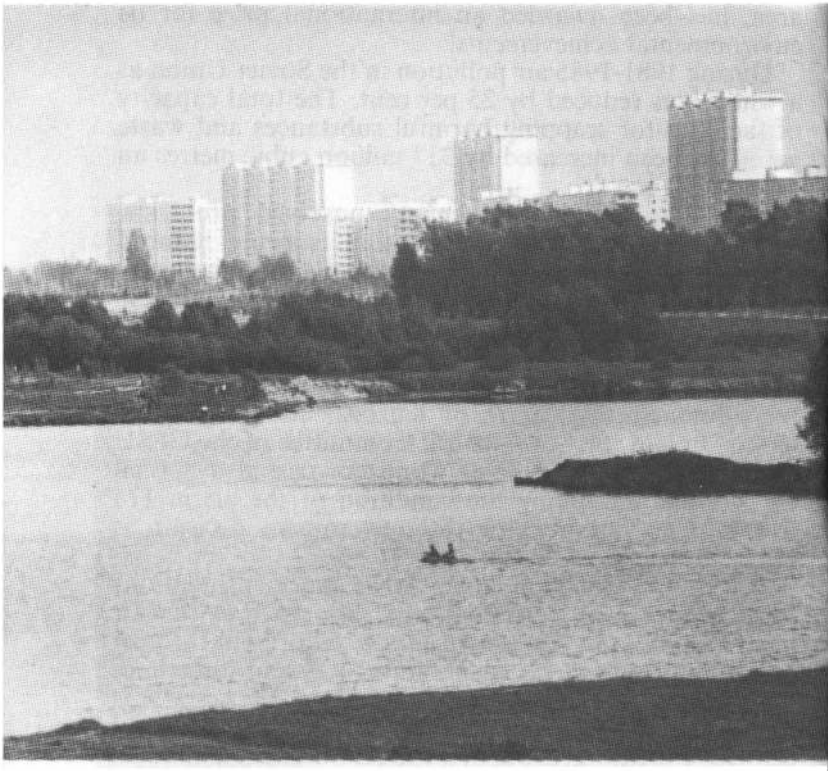
During 1981-1985 air pollution in the Soviet Union as a whole was reduced by 25 per cent. The total capacity of facilities for trapping harmful substances and waste gases has been increased by 337 million cubic metres an hour.

There are still a great many unsolved problems, however. The level of air pollution is being reduced relatively slowly in many cities of Siberia, the Urals and Kazakhstan. The situation is particularly alarming in the towns of the Kuzbas area, the "Siberian stokehold". The government agencies concerned have received numerous complaints about air pollution from Kemerovo, the administrative centre of Kuzbas, and from other towns. In late 1984 the Central Committee of the CPSU and the USSR Council of Ministers passed a special decision on improving the condition of the air in 174 towns. The fulfilment of this government decision is being strictly supervised.

In recent years more than 7,000 major installations for the treatment of industrial discharge into the air have been built in the Soviet Union. At present the cost of gas and dust treatment amounts to 10 and sometimes up to 30 per cent of the fixed assets of enterprises. Air is monitored constantly at hundreds of major industrial centres. Further growth of production is accompanied by a constant decrease in the concentration of dust and in the amount of untreated waste water. Discharge of waste into the air has been stabilized or reduced in 70 per cent of large industrial cities.

Considerable work to improve the condition of the air is underway in other socialist countries. In Bulgaria, for instance, 500 various facilities have been built in the last five years for trapping particles discharged into the air with smoke. These facilities trap 9 million tons of harmful substances annually. At present, 78 per cent of gaseous wastes is purified by filters.

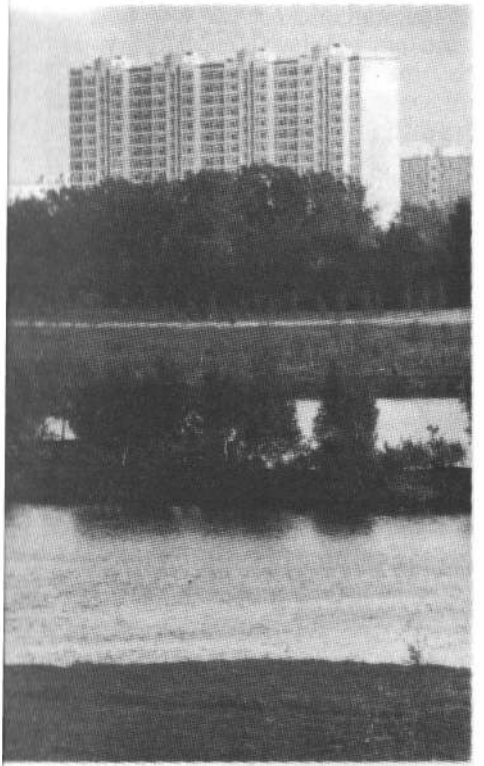
Switching over from brown coal to liquid fuel and natural gas and the installment of additional filters in the thermal power stations of Berlin, capital of the GDR, reduced the amount of harmful discharge into the air considerably. As a result, the release of sulfur



dioxide into the air has been nearly halved in the last ten years.

In Czechoslovakia the discharge into the air of sulfur and nitrogen oxides will have been reduced by 30-35 per cent by the year 2000 through the use of treatment facilities, improved internal-combustion engines, and higher-quality fuels and lubricants. The total amount of waste discharge into the air will thus be decreased by one million tons a year.

Motorization and the air pollution caused by exhaust fumes have created a serious problem for all big cities, and for the entire environment. The "most automotive" city in the world, Los Angeles, has developed a particularly noxious variety of air pollution known as "Los Angeles smog". The number of motor vehicles per



Strogino, a new housing development in Moscow, stands on the green banks of the River Moskva.

square kilometre in Federal Germany is over 100, i. e., more than the average population density in many countries! As much as 50-60 per cent of the air pollution in Munich, a large industrial centre, is due to exhaust fumes.

Though the Soviet Union and other socialist countries are behind the West in the automotive sphere, there are no plans to "catch up" in terms of ecological damage. The substantial modernization of the Soviet automobile industry during the 12th five-year development period (1986-1990) will involve strict requirements ensuring that motor vehicles are ecologically clean.

The scientists of socialist countries have jointly developed the hygienic limits of the concentration of air-pollutants. These limits are observed during the con-

Atmospheric monitoring is conducted in all major industrial centres of the Soviet Union. Pictured is one of the mobile air monitoring stations operating in Alma Ata, the capital of Kazakhstan.

struction and modernization of industrial enterprises. Many CMEA countries intend to modernize chemical plants in order to reduce air pollution. Various mechanical, biochemical and chemical methods of treatment are being used more extensively to purify atmospheric emission.

The soil

Regrettably, the soil of our entire planet should be entered into the Red Data Book. While practically all developed countries have made more or less substantial progress in air and water protection, they have mainly failed as regards the soil, our mother earth. The wide use of machinery and crop chemicals as the main means of obtaining higher crops is the primary cause of soil degradation. Machine tillage of the soil affects its natural fertility, while the ever-growing application of fertilizers and pesticides damages nature by changing the ecological conditions of human habitation.

Soil is a unique biochemical laboratory in which the mysterious life cycle of nature is endlessly repeated. Living in one gram of soil are nearly 100 million microorganisms, and countless invertebrates and larvae. Everything growing on earth owes its life to the work of these invisible creatures throughout thousands of millions of years, for life can be generated only by life. During one farming season this living matter is pressed and turned over and over again, crushed by the wheels of tractors, harvesters and sowing machines, ploughed, tilled and harrowed... The term "machine-induced degradation of soil" has already been entered into technical manuals, but unfortunately with great delay.

Machine-induced soil degradation has assumed a global character. In particular, wheeled tractors which raise 3-4 times more dust than crawler tractors, destroy the soil rapidly. In the United States alone heavy wheeled tractors have ruined nearly 40 million hectares of land since the mid-30s. The United States, the Soviet Union and other countries are rapidly expanding plowless land tillage. "Away with the plough!" is the call of

Exhaust emission is systematically checked in the Soviet Union. Motor vehicles with excessive exhaust are taken out of operation.

the time, and agronomists believe that world agriculture will enter the 21st century without the plough.

Soil over-compaction and the "processing" of its top layer into dust sharply reduce moisture accumulation, because the water remains on the surface. This drastically decreases the efficiency of chemical fertilizers. In the USSR 40 per cent of chemical fertilizers is wasted due to machine-induced degradation of soil. In order to double yields, the United States has been forced to increase the output of chemical fertilizers sixfold. Experts contend that excessive compaction of the soil leads to lower grain harvests and higher fuel consumption.

Farmers are increasingly reverting to the experience of their forefathers to reach the conclusion that manure is the best fertilizer. So-called organic farming is distinctly gaining ground.

How can soil degradation be stopped? The answer to this question is being sought by agronomists, biologists and ecologists all over the world. Journalist Anatoli Ivashchenko recently wrote about one such agronomist, Prokofi Zolotaryov, in his story *The Land* published in the Soviet magazine *Novy Mir* (New World). A few excerpts from this story follow below.

"In order to get bumper crops of wheat one needn't plough, or disk, or cultivate, or harrow, or roll the earth. One need only sow and take in the harvest."

Thus Prokofi Zolotaryov began his speech at a session of the Agricultural Academy in early 1969. He was interrupted by laughter and mocking applause. The discouraged agronomist left the rostrum...

Zolotaryov's statement ran counter to millennial practice. It was too dazzlingly daring, unbelievably simple and down-right original to be believed by all scientists, even by the prominent scientists present at the session. Such is the fate of many pioneering ideas no matter how correct they may be.

... The only implement Zolotaryov used was a blade drill he had designed himself.

... Even in hot weather "it's raining underfoot" on Zolotaryov's fields, because the natural soil is being preserved and not pulverized or rolled down by wheels.

... During the fourth year of the experiments the air temperature in the Don steppes (in the South of the

European USSR—Ed.) rose to 40° C, the ground cracked, while the top layer of the experimental field did not exceed a temperature of more than 23° C. Zolotaryov did not cut weeds during pre-sowing cultivation, and as a result there were 50 per cent fewer weeds on his field in the second year, and in the third year of the experiment very few weeds. In the fourth year there were no weeds at all. Hence Zolotaryov's conclusions:

—It is an objective law that the seeds of weed and cultivated plants lying open on the surface perish;

—mouldboard-ploughing after the seeding of weed and cultivated plants before winter is one method of seed accumulation.

Years of experimentation, observation, study of literature and analysis of facts led Prokofi Zolotaryov to the discovery that the soil has the property of developing drought. This is how he explains it:

"In the past the surface of the virgin steppe held the entire annual precipitation and released water gradually to springs. The ground was covered by a 1.5-2-centimetre layer of dying grass residues, below which lay steppe matting. As soon as the top layer dried up in the spring it was loosened and all evaporation ended. There was no surface run-off. The land under the matting was always moist. There were no droughts and vegetation thrived...

"It has been recorded that bare, loosened soil, deprived of plant cover by tillage, heats up to 50° and even 82° C. Covered by a blanket, it heats up only to 18-23°, or three-four times less! I should note that bare soil becomes this hot only at a depth of only one centimetre. A daily change in temperature is not observed at a depth of 3-5 centimetres.

"The mutilated land does not absorb water either, and this instead collects in puddles for a long period of time or runs off. Air, which is a poor conductor of heat, heats up on contact with the ground. Then a turbulent current throws it back up. As more air masses are brought to the hot surface they heat up and rise... Hot wind can dry up the top layers of moist soil within a single day".

Prokofi Zolotaryov, who is an expert in the history of agriculture, has elaborated the pattern of the emergence and growth of zonal drought. Ploughed land heats the air above to a height of more than two kilometres. The drying

also extends for many kilometres on the horizontal plane. The "perpetuum mobile" of the life cycle of nature begins to malfunction; the overheating of large tracts of land creates a major agricultural drought which disrupts the area's once stable climate: "Trees begin to dry up, the level of ground waters drops, the botanical composition of the vegetation changes, dust storms become more frequent and wash-out causes gully erosion... But this is only the beginning, and then... Then come semideserts and finally, deserts. Not finally, actually, because agricultural droughts join with permanent deserts to form a regional, and then global arid zone".

These are a few of the views of the Russian agronomist Prokofi Zolotaryov on the woes of modern farming, which have already struck one hundred states and with time continue to affect even more areas.

The great African drought, which has lasted for years, has assumed truly terrifying proportions. The resulting famine has already claimed millions of lives. The Sahara is rapidly advancing southward, scorching ancient agricultural areas with its fiery breath. During the last 50 years the Sahara has swallowed 650,000 square kilometres of land. This monstrous conflagration has engulfed 35 per cent of the Earth's entire land surface.

Earth and its fertility are one of nature's countless

A pine forest will be planted after the recultivation of a shale quarry in Estonia, one of the Soviet Baltic republics.

profound mysteries, which people have been studying for millennia. Nevertheless, only a tiny fraction of the mystery has been unravelled.

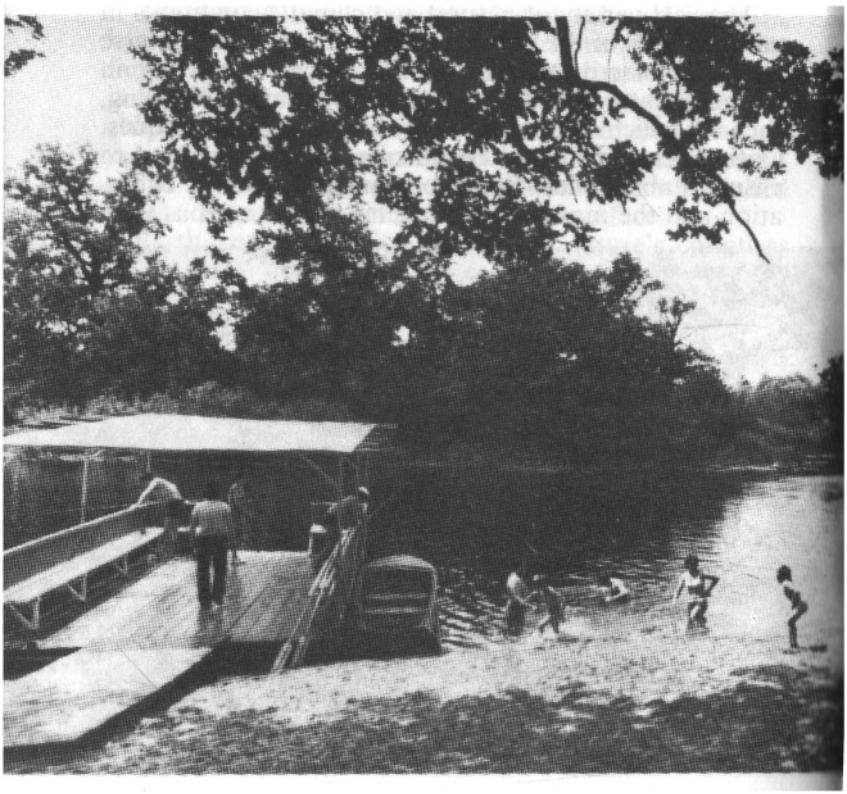
"...We must always remember that while agricultural lands give us food, all the other lands covered with vegetation provide us with oxygen, fixate carbon and regulate the cycle of biologically pure water. We should, therefore, as scientists and ameliorators of the soil, take care not only of arable land but of all the landscapes producing biomass, pure water and air and neutralizing the various industrial and agricultural wastes".

I have quoted Professor Viktor Kovda of Moscow State University, honorary doctor of many universities in the world, a recognized authority on soil science and the initiator and director of the FAO and UNESCO international programme "Soil Map of the World".

The vast variety of natural and climatic conditions in various parts of the Soviet Union determines the diverse character of crop cultivation. Each agricultural region of the country has different zonal systems of farming, each of which applies its own agricultural techniques. Optimal crop distribution and crop rotation are used to ensure stable yields. Soil-protecting methods of cultivation and the most suitable machinery are used as well.

Northern Kazakhstan was one of the first regions to adopt an advanced soil-protecting system of land tillage. The changeover from the customary, age-old tillage by plough to ploughless farming helps to avoid the dire consequences of droughts and obtain stable harvests. Ploughless tillage with the help of basically new implements, blade cultivators, reduces soil erosion and hence the loss of humus.

The soil-protecting system of cultivation has now been introduced on nearly 50 million hectares of arid land in the southern steppes of Western Siberia, in the Ukraine and areas east of the River Volga and in the southern Urals. Next it will be applied in more areas



along the Volga and in the non-chernozem zone in the centre of the European USSR.

In concluding the discussion on soil, I may note that in the Soviet Union, as in other developed countries, the ugly scars of industrialization disfiguring the face of the Earth have not yet been completely healed: these scars include the "moonscapes" created by all kinds of mining, the "Everests" of cinder dumps, and the "Marianas Trenches" dug in opencast mining.

Previously the USSR simply could not afford the implementation of costly land recultivation. The time has now come to settle our debts with nature, and we have thus planned to recultivate nearly 660,000 hectares of land by 1990.

A recreation zone has been set up on the site of old mine workings near the city of Stary Oskol in the centre of the European USSR.

UNDER THE GREEN CANOPY

The air, water and soil are not the only victims of man's forcible intrusion. The purity of the air and the preservation of bodies of water and soil largely depend on the conservation of forests.

The humanitarian—aesthetic and curative—functions of the forest are particularly important in urban areas where the majority of the population of industrialized nations is concentrated. Forests have a biological effect on man in that they increase the ionization level of the air and produce special chemical compounds, such as phytoncides. The microclimate of a forest has peculiar curative properties all its own.

Finally, forest plants filter water and help cleanse the air by retaining dust and neutralizing noxious chemicals. Furthermore, they reduce the level of noise in towns and villages. In the woods people seek a reunion with nature, a respite from the hustle and bustle of modern life and a source of new energy for daily work.

The psychological effect of the forest cannot be overestimated. The timeless voice of nature, the singing of birds and the rustle of foliage exert a most beneficial influence on a person's emotions and mental health. A mere view of a forest's beauty can improve a person's state of mind. The aesthetic value of nature, which has always been the domain of art, has become in our time a special discipline of ecological science as well. The scientific principles of the aesthetic value of forest landscapes are being developed to be used in the organization and establishment of recreational zones. The aesthetic character of nature must not conflict with its ecological essence.

Because of the mass-scale felling of forests, the most grievous loss inflicted by man on nature, there are only a little over 40 million square kilometres of woodland left on the Earth. Two-thirds of the globe's forests have been erased from the face of the Earth during the last ten thousand years. Man's destructive capacity has grown particularly rapidly in the last few decades. Today forests are retreating literally before our eyes.

The ruin of forests is a stern warning of impending ecological disaster. "Acid rains" also play a role in the destruction of forests. In Europe, for instance, coniferous trees are drying up all the way from the Mediterranean to the Baltic shores. Nearly half of all trees in Federal Germany are diseased, while 15 per cent of standing timber has been destroyed by disease in the Scandinavian countries.

We in the USSR hope that our northern forests and those west of the Urals, which are the richest and largest wooded areas in Europe, will not meet with disaster. But the calamity which has struck all of Europe and has already begun to affect the forests on the Kola Peninsula, concerns us greatly.

The most wooded of the socialist countries is the Soviet Union, whose forested areas cover over 800 million hectares of land and comprise nearly one-fourth of the world's total wooded area.

Siberia and the Far East account for nearly 80 per cent of the country's forests, and the bulk of the timber-felling industry is gradually being moved to these areas. But the Siberian forests must be exploited cautiously because the taiga is very vulnerable and its woods grow slowly. Whereas in the European regions of the country trees reach a commercial size at the age of 70-80 years, in Siberia they need 110-130 years to reach the same maturity because of the severe climate.

The rational felling of timber still presents a problem. In Siberia, for instance, where vast territories are not extensively developed and the lack of roads impedes the haulage of timber, trees are cut primarily in areas along transportation routes. As a result along with the over-matured timber ready for felling, trees at other stages of growth are cut as well.

To avoid this, roads should be laid deep into forest

areas, despite the great expense and labour involved. This is the only way to prevent the destruction of forests located near communities and along rivers.

There is no problem, however, with excessive felling of trees in some parts of the European USSR—in the Ukraine, Byelorussia and the Baltic republics, areas which have long been developed and have an adequate transport network.

Forest fires have been and remain a serious problem for all "wooded" countries. Every year a total of 200,000 forest fires flare up in the world. In 1915 Siberia was the victim of one of the world's most terrible fires when 16 million hectares of the taiga were engulfed in a mammoth bonfire. Apiaries, hunting grounds and hay fields burned along with the forest. The sun shone dimly and towns and villages were enveloped by a gray twilight for months. Because the wheat could not ripen for the lack of sunlight the fields were not harvested.

The maintenance of a substantial fire-fighting service is essential due to the forest fire threat. In Siberia up to 700 planes and helicopters are on fire patrol during the

months of June and July, the driest and most dangerous period of the year.

Thousands of specially trained people are engaged in protecting forests. Fire fighters are often dropped into the burning area by parachute and extinguish the blaze using water, explosives and, most recently, special solutions which evaporate only when heated at extreme temperatures. This work is difficult and often dangerous.

The Soviet Union is one of the world's leaders in reforestation. Every year two million hectares of land are replanted with trees in this country. Soviet scientists have developed rational methods of forest regeneration and new techniques of quality-seed breeding.

Reforestation makes it possible to increase the country's forest area despite the growth in timber felling.

New forests are also planted on a large scale, particularly in areas which were formerly woodless. For instance, over 35,000 hectares of forest have been planted in the steppes of the Kalmyk Autonomous Republic,

◀

The banks of the River Don are being stabilized by the planting of trees.

Young woods in Byelorussia.

The planting of saxaul and kandym, the most drought-enduring plants, in the Kara-Kum desert in Turkmenia.

in the lower reaches of the Volga. Afforestation of steppes is being carried out in the southern Ukraine, in the middle reaches of the Volga and in the southern Urals.

New woods and forest strips are planted as a measure to prevent the formation of gullies and the shallowing of rivers; in the southern regions of the country forests are planted to protect fields from hot winds.

Over five million hectares of new forests have been planted on the lands of collective and state farms,*

* A collective farm is a farmers' cooperative which is run on the basis of commonly owned means of production and collective work. The land is given free of charge to the collective farm by the state for perpetual use. A state farm is an agricultural enterprise owned and run by the state.

including nearly two million shelter belts which protect over 40 million hectares of cultivated fields.

Forest shelter belts prevent water erosion and reduce the wind speed in-between forest strips and thus diminish the potential danger dust storms present to the crops. Greater accumulation of moisture on the fields protected by shelter belts helps to increase yields.

The Soviet agricultural afforestation programme for up to the year 2000 provides for expanding agricultural production in sandy areas which have thus far been used only as pastures.

During the last twenty years 700,000 hectares of previously unused sandy land in the European part of the country have been reclaimed by means of afforestation. The planting of trees and shrubs in the Soviet Central Asian republics has helped to fix sands and thus increase pasture lands by 4.5 million hectares.

Purposeful afforestation of arid areas as part of a scientific system of land cultivation is an important means of protecting light soils and sands from desertification.

Forest-conservation and reforestation work is being carried out in other socialist countries as well. The particular climatic and soil conditions and the ecological situation in each country determine the varying scope and forms of this work.

RESOURCE SAVING AND NATURE CONSERVATION

Each year mankind extracts thousands of millions of tons of minerals and organic substances from the earth. Only ten per cent of this immense mass is put to use. The rest is returned to nature as waste, mostly harmful waste. Ideally, people would completely process everything they take from nature.

The pressure exerted on nature stems not so much from the growing scope of production as from the inadequacy of the existing technologies. The main task now is to develop technologies as similar to natural processes as possible. The fact is that nature wastes nothing. Thus industry in turn should not merely clean its waste products but rather operate in such a manner that would prevent their appearance.

Waste treatment is not the principal method of preventing pollution. The radical solution to the problem lies with the complete utilization of all substances present during a technological process. An ecological disaster can and must be avoided. Scientific and technological progress will provide the means to fight environmental pollution. Waste-free production will harmonize the relationship between man and nature.

The development of wasteless and resource-saving technologies presents an urgent economic problem to our country. The Soviet Union accounts for more than one-fourth of the world extraction of minerals; it holds first place in the world in the output of oil, gas and iron ore.

This enormous scale of production makes the economical and comprehensive use of natural resources a vital economic task. The multiple use of raw materials

makes it possible to increase the output of the end product, reduce the extraction of natural resources and thus improve the ecological situation.

Enterprises built in the Soviet Union can serve as examples of how technological problems can be resolved while taking due account of the environment. The Gorlovka nitrogen-fertilizer plant, built in the Ukraine before the Second World War, was one of the world's first waste-free factories. The Pervomaisky chlorine-and-alkali plant, also located in the Ukraine, operates on a closed non-waste cycle. The plant uses completely all raw materials and operates on a comparatively small amount of water, none of which is discharged into the environment.

The new technology of ammonia synthesis, employed at the Azot chemical plant in Nevinnomysk (the Northern Caucasus), uses a sharply reduced amount of water and emits no harmful substances into the atmosphere.

There are still more examples of new technologies which have been applied in the Soviet Union to make fuller use of raw materials and reduce the strain on the environment. The application of the direct steel-making process at the Oskol electric-smelting plant situated in the centre of the European USSR has made it possible to dispense with blast furnaces and coke ovens which present an environmental hazard.

One of the new technologies introduced at the "Fosforit" industrial complex in the Leningrad Region is the use of sand, which was formerly dumped, to make abrasives. All the rock removed during opencast mining is used for land recultivation, for making crushed stone and for other construction purposes.

The rational use of recoverable resources presents a major problem worldwide. The practice of using raw materials for only one purpose has outlived itself in respect of the economy, technology and ecology.

For example, recycling one ton of waste paper saves four tons of wood and 900 cubic metres of water and reduces air pollution by 86 per cent and water pollution by 76 per cent.

Municipal waste is another acute problem. Cities and towns discard millions of tons of refuse, most of which is transported out of the residential area. Dumping

areas cover hundreds of hectares of land that could be used for better purposes, while the decomposition of waste, lasting from 50 to 100 years, contaminates the air, the soil and the sub-soil waters.

Unfortunately, science and technology are yet to find a radical solution to this problem. At present, incineration of solid waste is the best solution. Almost all major cities in the world have garbage incineration plants. But this is by no means a satisfactory answer to the problem.

Experiments and industrial trials have shown that half of a town's refuse can be reused. It can be processed into compost, a valuable organic fertilizer. Compost plants are now operating in eight Soviet cities and are under construction in other towns. The serial production of equipment for these plants is being organized. But nevertheless, the problem has not been completely resolved, for much refuse potentially reusable still remains unprocessed.

WHAT CAN THE PUBLIC DO?

Environmental protection is a task requiring the joint efforts of government agencies and public organizations. An ecological crisis could not be caused by social reasons in socialist society. And yet socialism is not automatically void of environmental problems. In the operation of various departments and enterprises and in the work of certain executives there are, unfortunately, shortcomings which prevent efficient improvement of the environment. One of the main reasons for this situation is that specialists engaged in the national economy often lack ecological awareness.

Environmental ignorance inevitably aggravates the conflict between man and nature. This conflict can be avoided by fostering a scientific ecological awareness. That is why extensive work is being done in the Soviet Union and other socialist countries to foster a public understanding of the need to protect nature and to participate in this work. Nature preservation depends on the individual efforts of every member of society.

Ecological knowledge is dispersed widely through newspapers, magazines, radio and television. Writers and cinematographists take an active part in this work. Popular literature on ecology is being published in greater volume.

More attention is being paid to teaching the fundamentals of natural science. Several educational institutions are training ecologists. Lectures on nature conservation are included in the curriculum at colleges not directly concerned with ecological problems. Furthermore, much is being done to encourage students to take an active part in nature protection.

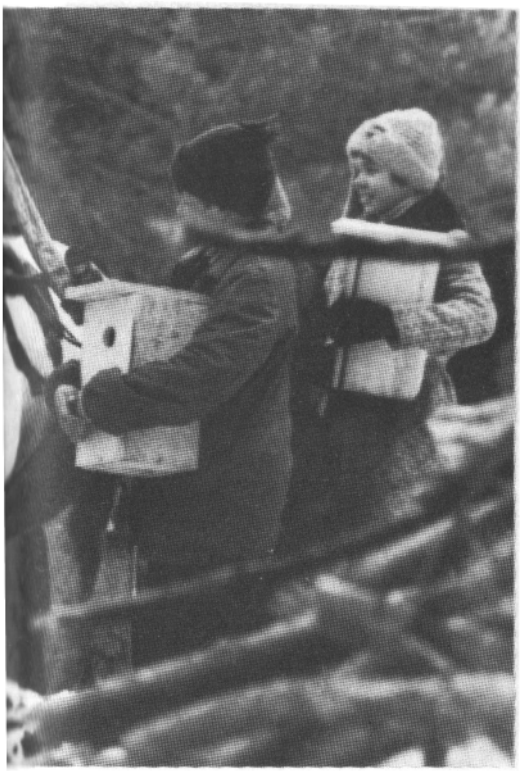
Extensive networks of voluntary societies for nature conservation have been established in socialist countries. For example, the society of nature-lovers in the German Democratic Republic unites 40,000 people and the nature conservation league in Poland, nearly 1.5 million. Scores of million of people are members of nature-protection societies in all 15 Union Republics of the Soviet Union. The Nature Conservation Society of the Russian Federation alone has a membership of nearly 40 million.

Besides their traditional activities, such as planting greenery in towns and villages, protecting national parks and preserves and helping to combat poaching, members of nature conservation societies encourage the population to take part in practical measures for nature

protection. During the last five years alone nearly 100,000 mass environmental projects have been conducted in the Soviet Union, in which more than ten million people took part.

Controlling the observance of environmental legislation is another role of nature-protection societies in the Soviet Union. This work takes the form of so-called ecological expert examinations conducted by the societies' scientific and technical councils. The activity of experts in the societies is coordinated with departmental inspections.

How effective is this activity? Here are two examples. A programme was drafted in the Omsk Region of Siberia to reclaim over a million hectares of land by draining swamps and uprooting woods. The members of



By tradition schoolchildren make and hang up starling-houses before the birds arrive in spring.

the Omsk regional branch of the nature conservation society studied the project and concluded that such a major operation would have an adverse effect on the environment. They argued that it would be far more sensible to reclaim two million hectares of unused saline land, rather than the one million hectares of wet land. Local authorities took the recommendation into account and made the necessary amendments in the land-improvement plans.

Another example. The original plans for the construction of the Bureya hydroelectric power station in the Far East were amended on the demand of the nature conservation society after its members concluded that the project could have a harmful ecological effect.

The record shows that the conclusions reached by the experts of government agencies on environmental matters are not always sufficient. It is not so much a matter of competence as of the very approach to the problem. In authorizing the construction of an enterprise, experts are inclined to be guided primarily by the interests of their own department. Fishery specialists, for instance, studying the project of a hydroelectric station, are most concerned with the welfare of the fish, while power

A "green patrol" of a school forest range near Borisov in Byelorussia.

Young wood growers of the Zhukovka school forest range in the Bryansk Region (centre of the European USSR).

engineers are concerned with other matters. Experts of nature conservation societies, free of departmental considerations, approach the environmental problem in its entirety. In the case of a hydroelectric station, they are interested not only in fish, but also in the forests along the banks of the reservoir, changes in the landscape, etc.

One form of ecological control are mass public campaigns to check the protection of certain natural resources. During 1981-1985 alone 100,000 persons took part in such public campaigns. The purpose of one such drive was to help maintain the purity and water level in small rivers, which is an important way of improving the country's water balance. The results of the examination served as the basis for decisions reached by the Council of Ministers of the RSFSR*. Meanwhile, during the course of the public environmental campaign, many shortcomings had been rectified.

Educating children, who are the future masters and protectors of our planet, in environmental matters is given special attention. Love and concern for nature are

* RSFSR, the Russian Soviet Federative Socialist Republic, is one of the Union Republics forming the USSR.

fostered both during biology and geography lessons at school and in the course of various extracurricular activities.

One such extra-curricular activity is the management of forest ranges by schools. In some parts of the Soviet Union schoolchildren have "forests of their own". For example, a fine pine forest has grown along the sloping sandy banks of the Volga river on the boundary between the Ivanovo and Kostroma regions. The students who planted it are now teaching their own children to take care of the trees. In the Kostroma Region alone there are 75 school forest ranges which take care of 30,000 hectares of woods, one-fifth of which have been planted by children.

Members of school forest ranges help restore forests in felling areas. The schoolchildren of Ust-Ilimsk in Siberia, for instance, plant trees, take care of the undergrowth remaining after the felling of trees and clear fallen trees and deadwood from forests.

Another form of ecological education is children's participation in Operation "Live Silver" which aims at saving fish, studying the life of bodies of water and keeping these bodies of water clean.

Although much is being done in socialist countries to enhance the ecological awareness of the population, a great deal of work still remains. The love of nature and of everything living around us is an inalienable part of humanism and of man's lofty calling on the Earth.

WILL THE EARTH BE LUCKY A THIRD TIME?

According to one hypothesis, our planet was twice threatened with the fate of becoming a lifeless celestial body and thus sharing the lot of Venus and Mars, its neighbours in the solar system. Four and a half thousand million years ago, when the Earth's atmosphere had just begun to form, a mere 5°C separated it from the fatal boundary beyond which begins the "greenhouse effect" which turned the surface of Venus into a seething inferno. Two thousand million years later a mere +1°C saved the Earth from freezing under a blanket of ice such as that which covers Mars today.

Now Mars, the Roman god of war, threatens, both literally and figuratively, to reign supreme on the Earth and turn it into an iceberg in space. The sad truth is that the transformation of the common home of all people into an icy desert may be brought about by man himself, who stands at the tree of life with a thermonuclear axe in his hands.

Immense amounts of dust, soot, ash and smoke, thrown up into the Earth's atmosphere by the monstrous force of thermonuclear explosions, would screen out the Sun for a long period of time, and screen it out from people forever. The heaven would turn upside down, so that cold would descend upon the Earth, while heat would be trapped in the upper layers of the atmosphere. All the continents would turn into Antarctics, but their snow and ice would be black. The rays of the Sun would take so long to reach the Earth that none of us would ever find out how long the "nuclear winter" would last...

Such in general outline is the description of the

thermonuclear Apocalypse, a description, handed down to us not by John the Apostle but computed separately by Soviet and American scientists, and later confirmed by their West European colleagues. The prospect of a "nuclear winter" forces us all, both in the East and in the West, to take a sober look at the harsh reality.

That certain truths have become obsolete signifies that we have reached troubled times, when many pre-nuclear doctrines and postulates must be discarded. once and for all. This above all applies to the indisputable thesis of the pre-nuclear past, put forward by von Clausewitz,* that war is nothing more than the continuation of politics by other means. The only possible continuation of politics in our time is peace.

People everywhere must learn the truth about nuclear war. According to UN experts, its very first explosions would instantly kill 200 million people and inflict grievous wounds on another 60 million. The probable overall number of victims of the first nuclear strikes would be 700-800 million civilians and 70-80 million combatants. Within just a few days of an all-out nuclear war one-third of mankind would perish. The fate of those surviving would be even more tragic for the inevitable death from radiation poisoning is excruciatingly painful.

Regrettably, many do not yet realize this. Militarist misinformation affects people's minds and moods just as harmful wastes contaminate the environment. The ever-widening flood of misinformation makes the problems of protecting man's "internal environment", the ecology of reason as it were, as important today as the questions of nature conservation. I refer in particular to the modernization of the old and the advancement of the new "theories" of a possible victory over the USSR and its allies in a third world war. The psychological radiation to which the Western people are exposed by militarism has reached a critical level.

The militarists employ the entire propaganda might of the mass media to impress upon people that nuclear war is possible, inevitable and even... desirable. Horrendous terms have come into use, such as "megadeath"—

---

* Karl von Clausewitz (1780-1831), a Prussian general, military theorist and historian.

a unit of "omnicide" denoting the death of one million people (derivative from "megaton", a unit of thermonuclear explosive equivalent to one million tons of trinitrotoluene).

The modern Herostratoses intend to burn the temple not of Artemis, but of life, so far the only one known to exist in the Universe. They even advance a philosophy of their own, including such wise postulates as "it is better not to exist than to coexist" and "there are things more important than peace".

A nuclear war can be neither protracted nor limited. Should its scourge befall mankind, it would immediately become global, total and final. It would be a war with no front, rear or no-man's land. Thousands of towns would be wiped off the face of the Earth and entire nations would be instantaneously consumed by nuclear flames. "Nuclear winter" and lethal radiation would spread inexorably over the entire planet, sowing universal death. People in Japan often point out that three times as many people died in Hiroshima due to the effects of radiation in the five years after the atomic bombing as at the moment of the explosion. Geneticists have every reason to warn that the radiation effects of a nuclear war would lead to the extinction of the biological species Homo sapiens.

Previously, losses were always counted when the battle or war ended. This may no longer be possible, for the price of a thermonuclear war is the death of the entire human race. That is why those theorizing on the permissibility of solving political problems by military means should be universally and mercilessly ostracized. It is necessary to cleanse politics, ideology and the mass media from militarist contamination, for it is the most dangerous pollution ecologically unacceptable both for the mind and for the soul.

Regrettably, however, militarism has nearly attained an autonomous status, becoming a "thing in itself". Experts have calculated that in 1985 the world's military expenditure reached the million-million-dollar mark. Thus militarism is opening up a trillion-dollar account.

Trillion is in American notation a figure of 13 digits, which can only be conceived as a mathematical notion. Its comprehension in real terms is practically im-

possible. Suffice it to say that our entire civilization, from the Egyptian pyramids to the present day, has lasted for barely 150,000 million, or slightly more than one-seventh of a trillion seconds.

A trillion dollars almost equals Japan's gross domestic product. This sum can guarantee employment for 20 years for many millions of people. It can solve the global food, ecological, energy, medical and other problems relentlessly confronting mankind on the threshold of the year 2000, the dividing line between centuries and millennia.

The economic and political programme of the arms manufacturers amassing fabulous profits is quite clear. Their economic objective is a continuous arms race which will last for decades. Their political aim is the constant aggravation of international tensions and the spiritual militarization of society.

The arms race and ecology are inversely proportional and incompatible. The colossal and wasteful expenditure of all resources—raw materials and other supplies, manpower and scientific and technological potentials—impedes the solution of ecological problems both on the regional and global scale.

Sixty million skilled, well-educated and energetic workers and specialists worldwide are in one way or another employed in the military sphere. Roughly one out of every four scientific workers on the planet is engaged in military research.

Forty per cent of the world's expenditure on science is connected with improving or developing new, truly fantastic weaponry.

As a result mankind simply cannot afford to promote nature conservation. We are indeed not living at the best of times in this "best of worlds".

During the 80s the human race has accelerated its "race into oblivion" and approached the fatal line which to cross would be tantamount to suicide. It is vitally necessary to reverse the negative tendencies of confrontation which have developed lately and to clear the way for curtailing the arms race on Earth and preventing an arms race in outer space. A general reduction in the war threat and the promotion of

confidence as an essential component in relations between states must also be achieved.

On January 15, 1986 Mikhail Gorbachev, General Secretary of the CPSU Central Committee, issued a Statement proposing a concrete programme aimed at the complete elimination of nuclear weapons worldwide within a well-defined period of time. The Soviet Union proposes that a step-by-step, consistent process of ridding the Earth of nuclear weapons be implemented and completed within the next 15 years, before the end of this century. Furthermore, it proposes that militarization of outer space be halted and chemical weapons be eliminated.

The statement reads as follows: "Initiating active steps to halt the arms race and reduce weapons is a necessary prerequisite for coping with increasingly acute global problems—those of the deteriorating state of man's environment and of the need to find new energy sources and combat economic backwardness, hunger and disease. The pattern imposed by militarism—arms in place of development—must be replaced by the reverse order of things—disarmament for development."

Many Western specialists, including authoritative scholars, believe that our civilization may poison itself even without a nuclear war, that we may be suffocated by industrial wastes and wither away amid environmental degradation. The only source of funds for environmental protection is disarmament.

Is it realistic to hope that the world economy will switch over to one based purely on civilian production? Sceptics will no doubt hasten to recall the crusades, the Mongol invasions, the hundred years' and other wars, the short respites between which were called peace, the fact that imperialism plunged mankind into the nightmare of two world wars during the 20th century and that wars are being waged in the world even today.

It is far too easy to call the dream of beating swords into ploughshares an utopia, one of the good intentions with which the road to hell is known to be paved. But the time has come for this dream to be realized.

It stands to reason that the reconversion of military production is a very complex problem. Its solution is

likely to take many years and great efforts in order to switch over immense funds to the struggle against famine, disease and social injustice, to the protection of the environment and other worthy projects.

It is equally obvious that such a reconversion can be effected only in conditions of peace. That is why it is now essential above all to revive detente and to reconsider all the obsolescent political concepts. This will require enormous effort, persistent work and struggle. Mankind can no longer live and act in the old way. The universal struggle against war is the only way to preserve peace. Only then will we be able to give a positive answer to the question: will the Earth be lucky for a third time?

All of us, earthlings of the present generation, are a link in the chain of universal human progress. We are answerable both to our ancestors and to future generations. Our duty is not only to save the Earth from a thermonuclear catastrophe but also to begin, through the joint efforts of all states, to heal its wounds, to save it from another possible catastrophe—an ecological one.